

# Observations On Two Sympatric Species of Buprestidae (Coleoptera) From Sand Dunes on the North Coast of New South Wales.

By T. J. HAWKESWOOD\*

## Abstract

Three species of jewel beetle, *Agrilus australasiae* Laporte & Gory, *Cisseis scabrosula* Kerremans and an unidentified *Cisseis* species, were collected from leaves of *Acacia sophorae* (Labill.) R. Br. on foredunes near Coffs Harbour, New South Wales, during December, 1978. Observations on the behaviour, host plant specificity and predators of *A. australasiae* and *C. scabrosula* are recorded and discussed for the first time.

## Introduction

The Buprestidae are a large family of beetles, well represented in Australia. About 800 species are presently known and many others await description. Despite the large number of species and the apparently widespread distribution of a few species, very little information is available at present on their exact distribution, plant preferences, behaviour and breeding biology.

However, there have recently appeared a number of papers which have greatly increased our knowledge of the Australian buprestid fauna. Barker (1975, 1977) has revised *Astraeus* and provided a checklist of *Stigmodera* (*Castiarina*) (Barker, 1979). Williams (1977) and Hawkeswood (1978) have provided data on buprestids from areas around Sydney which are being threatened by urban development. Peterson and Hawkeswood (1980) have recently provided notes on the general biology of *Diadoxus* from Western Australia.

Further information on buprestid behaviour, distribution and food plants

of two species of Australian Buprestidae is provided here for the first time.

## Observations

On the 11 December 1978, a visit was made to Hungry head, a beach approximately 21 km south of Coffs Harbour, north-east New South Wales (30°31'S, 153°02'E). A large number of individuals of *Cisseis scabrosula* Kerremans were collected from the leaves (or stems) of non-flowering *Acacia sophorae* (Labill.) R.Br. plants between 1020 and 1235 hrs (Eastern Standard Time). During the course of observations and collections of *C. scabrosula*, *Agrilus australasiae* Laporte & Gory and a further (unidentified) *Cisseis* species were also noticed in fewer numbers on *A. sophorae* stems and leaves.

During the course of observations, temperatures varied from 29-32°C and there was a slight sea breeze.

Selected plants of *A. sophorae* (growing along a 100m stretch of foredunes) were closely examined for a period of 5 minutes each, during which time, the number of males and females of *C. scabrosula* were recorded, as well as the number of pairs in copulation and the frequency of which escape mechanisms occurred (Table 1). In addition, similar observations were made on individuals of *A. australasiae*. Plants chosen for study were growing more than 3 metres apart to minimize counting individuals more than once which flew from one plant to an adjacent plant during the course of one observation period.

## (A) Notes on escape behaviour

Hawkeswood (1978) observed three

\* Department of Botany, James Cook University, Townsville, Queensland, 4811.

Table 1. Observations on *Cisnois scabrosula* Kerremans from eight *Acacia sophorae* plants at Hungry Head, north-east New South Wales on 11 December, 1978.

Plant number	Number of beetles per plant (during obs. period) *			Number of pairs observed in copulation per plant	Number of times "upward flight" occurred (during each obs. period) *	Number of times "tree-fall and flight" occurred (during each obs. period) *	Number of times thanatosis occurred (during each obs. period) *
	♂	♀	Total				
1	23	20	43	4	4	2	1
2	15	8	23	2	1	1	0
3	12	21	33	5	4	1	1
4	8	11	19	2	0	1	0
5	11	15	26	3	2	1	0
6	5	8	13	1	1	0	0
7	10	4	14	2	1	0	0
8	8	12	20	3	1	1	0
Totals	92	99	191	22	14	7	2
Averages (per plant)	11.5	12.4	23.9	2.75	1.75	0.88	0.25

\* = Observation period = 5 minutes for each plant.

(Voucher collections of *C. scabrosula* are housed in the author's private collection).

Table 2. Observations on *Agrius australasiae* Laporte & Gory from twelve plants of *Acacia sophorae* at Hungry Head, north-east New South Wales on 11 December, 1978.

Plant number	Total number of beetles per plant (during obs. period)*	Number of times "upward flight" occurred (during each obs. period)*	Number of times thanatosis occurred (during each obs. period)*
1	1	1	0
2	2	1	1
3	2	1	1
4	1	1	0
5†	3	1	1
6†	1	0	0
7†	2	1	0
8	2	1	1
9†	2	1	0
10	4	1	1
11	2	1	0
12	1	1	0
Totals	23	11	5
Averages (per plant)	1.9	0.9	0.4

\* = Observation period = 5 minutes for each plant.

† = One voucher specimen was collected from each of these plants before observations on escape behaviour were undertaken.

(Voucher specimens are housed in the author's private collection).

escape mechanisms exhibited by adults of Australian Buprestidae. Briefly these are (a) "upward flight" — when disturbed, the beetle stops moving, quickly opens its elytra and flies upwards rapidly before flying in other directions, (b) "free-fall and flight" — the beetle usually falls a short distance from a stem, leaf or flower of the food

plant and then flies away before hitting the ground, and (c) thanatosis or "free fall and death feign" — the beetle merely drops to the ground and there remains in an "inert" condition usually with the ventral surface facing upwards.

(i) *Cisseis scabrosula* Kerremans

This buprestid exhibited all three

escape mechanisms when approached or disturbed (Table 1). Of the 23 observations on escape behaviour, "upward flight" was the most frequent with 14 occurrences (i.e. 60.1% of the total), while 7 occurrences (30.1%) of "free-fall and flight" were observed and only 2 occurrences (9.8%) of thanatosis were recorded (Table 2). An additional behavioural trait to that previously recorded on *Cisseis* (Hawkeswood, 1978; and unpublished data) was noted on *C. scabrosula*. When approached to within about 30cm, some beetles ceased movement, reversed direction (so as to move down the *Acacia* stem) and then moved to the surface of the stem facing away from the predator (in this case the author). Beetles then proceeded down the stem for a distance of a few centimetres before flying away, or displaying the "free fall and flight" escape mechanism. Thanatosis was usually exhibited upon immediate danger i.e. when the author suddenly moved in to capture a resting beetle.

(ii) *Agrilus australasiae* Laporte & Gory

This species was present in much fewer numbers than *Cisseis scabrosula* (Table 2). A total of 16 occurrences of escape behaviour were recorded (Table 2). Of these, 11 occurrences (i.e. 68.8% of the total) of "upward flight" and 5 occurrences (31.2%) of thanatosis were recorded, while "free-fall and flight" was not observed (Table 2). Individuals of *A. australasiae* were more adept than those of *C. scabrosula*. No mating was observed in *A. australasiae*.

(iii) *Cisseis* sp.

Since all three specimens observed were also collected for voucher material, no observations on their behaviour were possible. This species will not be discussed until further collections and observations are made. It is mentioned here in the interest of it being a third sympatric species on *Acacia sophorae* at Hungry Head.

**(B) Host plant specificity**

All three buprestids appeared to be restricted to *Acacia sophorae*. Examination of other plants on the dune system (i.e. *Carpobrotus glaucescens* (Haw.) Schwartes (Aizoaceae), *Spinifex hirsutus* Labill. (Poaceae) and *Banksia integrifolia* L.f. (Proteaceae)), indicated that buprestids were not utilizing these as secondary food sources at the time, since no individuals were found on these plants. A few individuals of *C. scabrosula* were observed feeding on *A. sophorae* leaves and both buprestids fed readily on *A. sophorae* leaves in the laboratory (at the Botany Department, University of New England, Armidale). An examination of a small sample of *Acacia* plants in the field showed extensive leaf damage, probably due to feeding by these three buprestids, since no other phytophagous insects were observed on the foliage.

**(C) Other behavioural observations**

Not all *Acacia* plants were occupied by buprestids. Observations suggested that only 15-20% of the *Acacia* plants growing in the 100 metre tract of dune sampled were being utilized by the buprestids and these were all in the one area.

*Cisseis scabrosula* congregated on both sides of leaves and on stems towards the ends of branches. Mating readily occurred during these congregations, although no eggs were deposited. Of 191 *C. scabrosula* counted, 22 pairs (representing 23% of the total number counted, Table 1) were found in copulation. Copulation lasted 10-30 seconds. No mating between individuals of *Agrilus australasiae* was observed.

Between 4 and 11 individuals of *C. scabrosula* were present on leaves and stems (at any one period of time per plant), mostly at the ends of branches. The number of males and females present per plant was variable (Table 1), but overall, approximately equal numbers of males (92) and females (99) were

counted (Table 1). The occasional specimen of the unidentified *Cisseis* species was present amongst the groups of *C. scabrosula*. Individuals of *A. australasiae* tended to be absent from plants upon which *C. scabrosula* were common. The plants occupied by *A. australasiae* were usually smaller (0.3-0.4 metres high) than those commonly utilized by *C. scabrosula* which were 0.4-0.7 metres high.

#### (D) Predation by spiders

A spider, *Uloborus* sp. (Uloboridae), was resident amongst the *Acacia* foliage in few numbers. From a total of 35 webs examined on the foredune, only five (14.3%) were occupied by spiders. Their webs were thin and relatively weak, but examination of two adjacent webs showed that two small *C. scabrosula* (both males) had been captured. One beetle was dead and wrapped in silk while the other was unsuccessfully trying to escape from the web. The spider quickly pounced on the beetle, immobilized it by biting the muscular tissue between the thorax (pronotum) and elytra and began feeding on the beetle's fluids. The spider fed for about two minutes and then wrapped the dead beetle in silk.

#### Discussion

Since Kerremans (1898) described *Cisseis scabrosula*, almost nothing has been published since on the species. Carter (1929) lists its distribution as New South Wales and Victoria and includes it in his key to *Cisseis* (Carter, 1923).

*Cisseis scabrosula* is an alert and active insect and may exhibit several escape mechanisms when approached. Its tendency to move to the opposite side of *Acacia* stems when approached, is an addition to the patterns of escape behaviour previously noted in *Cisseis* by Hawkeswood (1978). Linsley and Ross (1976) note that the buprestid *Hippomelas sphenica* (Le Conte) from North America has the habit of moving to the opposite side of the branch when

disturbed. However, these authors do not mention whether any further escape behaviour occurred after the beetles had moved.

Rapid movement to the other side of a branch when approached may enable beetles to become obscured from a predator's sight. This behaviour may also permit beetles to adopt a cryptic position on the stems (especially near the base of the phyllodes). In the event of further danger from predators, rapid methods of departure would facilitate the insects' safety. At present, little is known about predators of Australian buprestids. It is likely that the escape mechanisms exhibited by *Cisseis* (and other genera) have played an important role in their survival and evolution.

The congregations of *C. scabrosula* on branch tips is probably related mainly to sexual activities, for it is here that mating commonly takes place. *C. scabrosula* also appears to prefer feeding and mating on larger plants of *A. sophorae*. These sites are fully exposed to sunlight and permit ready flight and escape, and probably give beetles better opportunities to detect moving predators.

There are very few reports of predation on Australian jewel beetles. Douglas (1954) reported the dusky wood swallow (*Artamus cyanopterus*) as a predator of an unidentified *Curis* species. Barker and Inns (1976) first recorded an asilid fly (*Phellus piliferus*) feeding on a large jewel beetle, *Stigmodera (Themognatha) tibialis* Waterhouse from Western Australia. Hawkeswood (1980) first recorded the spider *Araneus* sp. (Araneidae) as a predator of the small *Stigmodera (Castiarina) picta* Laporte & Gory near Gingin, Western Australia. That spiders do predate on buprestids, is further substantiated here.

*Agrilus australasiae* was described by Laporte and Gory (1837) and since then the only notes published on its biology are those by Froggatt (1902). He states:

"This is a plentiful species upon the foliage of this wattle [*Acacia decurrens* (Wendl.) Willd.] in the early summer in the Mittagong district (New South Wales; 34°27'S 150°27'E) where numbers can be taken by shaking the branches into a net or umbrella." recorded (Table 1). An additional made to Hungry Head, a beach approximately disturbance. Little is known about the biology of the Australian species of *Agrilus* but the data at hand suggests that they are specifically foliage feeders on *Acacia* leaves.

The three buprestid species appear to occupy a habitat which is restricted to a narrow zone on the sand dunes adjacent to the ocean. It is possible that *Acacia sophorae* is the only species which they utilize for food and breeding purposes in the Coffs Harbour area. Since they appear restricted to *Acacia* along the dunes, any future disturbance to this environment (e.g. clearing of the dunes for residential development, which is at present occurring to some extent) could lead to their extinction in these areas.

#### Acknowledgements

I would like to thank Dr J. D. O'Dea (Department of Physiology, University of New England, Armidale, N.S.W.) for critically examining earlier drafts of the manuscript. Thanks are also expressed to Messrs. D. Knowles and M. Peterson (Perth, W.A.) for reading and commenting on an earlier draft which was written in 1979. Lastly, I would like to thank Mr Bruce Murray (Bellingen, N.S.W.) for accompanying me to Hungry Head and Mylestom Beach and for assistance in field observations and collections.

#### REFERENCES

- Barker, S. (1975). Revision of the genus *Astraeus* Laporte & Gory (Coleoptera: Buprestidae). *Trans. R. Soc. S. Aust.* 99, 105-141, text figs. 1-25.
- Barker, S. (1977). *Astraeus* (Coleoptera: Buprestidae): A description of three new species and new locality records. *Trans. R. Soc. S. Aust.* 101, 11-14, text figs. 1-4.
- Barker, S. (1979). New species and a catalogue of *Stigmodera* (*Castiarina*) (Coleoptera: Buprestidae). *Trans. R. Soc. S. Aust.* 103, 1-23, text figs. 1-4.
- Barker, S. and R. Inns. (1976). Predation on *Stigmodera* (*Themognatha*) *tibialis* by a fly. *West. Aust. Nat.* 13, 147-148, fig. 1.
- Carter, H. J. (1923). Revision of the genera *Ethon*, *Cisseis* and their allies (Buprestidae). *Proc. Linn. Soc. N.S.W.* 48, 159-176.
- Carter, H. J. (1929). A checklist of the Australian Buprestidae. *Aust. Zool.* 5, 265-304, plates 1-3.
- Douglas, A. M. (1954). Observations on feeding of dusky wood-swallows. *West. Aust. Nat.* 4, 94-95.
- Froggatt, W. W. (1902). Insects of wattle trees. *Agric. Gaz. N.S.W.* 13, 701-720, text figs. 1-18.
- Hawkeswood, T. J. (1978). Observations on some Buprestidae (Coleoptera) from the Blue Mountains, N.S.W. *Aust. Zool.* 19, 257-275, figs. 1-2.
- Hawkeswood, T. J. (1980). A spider feeding on a jewel beetle. *West. Aust. Nat.* 14, 236.
- Kerremans, C. (1898). *Buprestides* nouveaux de l'Australie et des regions voisines. *Ann. Soc. ent. Belg.* 42, 113-182.
- Laporte, F. L. and H. Gory (1837). "Histoire naturelle et Iconographie des Insectes Coléoptères. Tome II. Suite aux Buprestides". (P. Dumenil, Paris).
- Linsley, E. G. and E. S. Ross (1976). Plant associations among adult *Hippomelas*. (Coleoptera: Buprestidae). *Pan-Pacific Ent.* 52, 272-285, figs. 1-2.
- Peterson, M. and T. J. Hawkeswood, (1980). Notes on the biology and distribution of two species of *Diadoxus* (Buprestidae: Coleoptera) in Western Australia. *West. Aust. Nat.* 14, 228-233.
- Williams, G. A. (1977). A list of the Buprestidae (Coleoptera) collected from *Leptospermum flavescens* Sm. at East Minto, New South Wales. *Aust. ent. Mag.* 3, 81-82.

---

## New Book

"Useful Wild Plants in Australia."

A. B. & J. W. Cribb (Authors of "Wild Food in Australia.")

269 pages. Few Color Plates.

Price \$15.95 (Discount to members) Postage 50km \$1.00 Vic. \$1.40.

Order from Sales Officer F.N.C.V.